

Honors Chemistry - Equilibrium Problem Set

Stasya

1. Write the equilibrium expression for the following reaction: $\text{AgCl (s)} \rightleftharpoons \text{Ag}^+(\text{aq}) + \text{Cl}^-(\text{aq})$.

2. K_{eq} for the reaction $2\text{A} + \text{B} \rightleftharpoons 2\text{C}$ is 8.0. Find the concentration of C when the concentration of A is $5.00 \times 10^{-4} \text{ M}$ and the concentration of B is $2.50 \times 10^{-4} \text{ M}$.

3. When 2.0 mol of carbon disulfide and 4.0 mol of chlorine are placed in a 1.0 Liter flask, the following equilibrium system results. At equilibrium, the flask is found to contain 0.30 mol of carbon tetrachloride. What quantities of the other components are present in this equilibrium mixture? What is the equilibrium constant at this temperature? $\text{CS}_2(\text{g}) + 3\text{Cl}_2(\text{g}) \rightleftharpoons \text{S}_2\text{Cl}_2(\text{g}) + \text{CCl}_4(\text{g})$

4. Suppose you dissolved benzoic acid, $\text{C}_6\text{H}_5\text{COOH}$, in water to make a 0.15 M solution. K_a for benzoic acid = 6.3×10^{-5} at 25°C . Solve for the concentration of benzoic acid, the concentration of hydronium ion, the concentration of benzoate anion, and the pH.

5. When ammonia dissolves in water, it reaches the equilibrium described by the following equation: $\text{NH}_3(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{NH}_4^+(\text{aq}) + \text{OH}^-(\text{aq})$. The value of the equilibrium constant is 1.8×10^{-5} . At equilibrium, if $[\text{NH}_3] = 0.25 \text{ M}$ and $[\text{NH}_4^+] = 7.5 \times 10^{-2}$, what is the concentration of $[\text{OH}^-]$?

6. At 740°C , $K_{\text{eq}} = 0.0060$ for the decomposition of calcium carbonate (CaCO_3). Find Q and predict how the reaction will proceed if $[\text{CO}_2] = 0.0004 \text{ M}$. $\text{CaCO}_3(\text{s}) \rightleftharpoons \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$.

7. Methanol, CH_3OH , if accidentally consumed by a human will oxidize in the human body to form formaldehyde, H_2CO (also called embalming fluid) and

hydrogen gas. If 1.25 M methanol is consumed, after 12 hours 16.50% of the methanol will be converted to formaldehyde. What is the K_c for the reaction?

8. An increase in the concentration of O_2 in the equilibrium system $2H_2(g) + O_2(g) \rightleftharpoons 2H_2O(g)$ will cause $[H_2]$ to what?

9. A 1.00 mol sample of CO_2 is heated to 1000K with the excess graphite in a 40.00L container. At this temperature, K_c is 2.11×10^{-2} for the reaction: $C(\text{graphite}) + CO_2(g) \rightleftharpoons 2CO(g)$. What are the equilibrium concentrations of each species? If the volume of the flask is changed so a new equilibrium is established in which the amount of CO_2 in the flask equals the amount of CO , what is the new volume of the flask?